1. Summary

This FireBIM Gender Action Plan is part of the FireBIM project, deliverable 1.2. The purpose is to reduce gender biased outputs from the project as well as hinder gender bias during the work in the project.

Gender Action Plan for the FireBIM Project

1. Introduction

The FireBIM project aims to innovate the fire safety design through the integration of Fire Regulations with Building Information Modelling (BIM) across multiple countries. Although FireBIM is a highly technical project cantered on regulatory compliance, integrating a gender perspective is crucial for ensuring digital inclusion[1], preventing algorithmic bias, and promoting equitable access to fire safety automation. The digital gender divide remains a critical issue in the EU, particularly in the ICT and AEC (Architecture, Engineering, and Construction) sectors, where women are significantly underrepresented[2,3]. This lack of diversity affects the development and implementation of digital tools, shaping how fire safety regulations are interpreted and applied. To address these challenges, FireBIM will adopt an intersectional and universal design approach, acknowledging that gender is only one dimension of digital inclusion.

This Gender Action Plan outlines strategies to ensure gender equality within the project's structure, activities, and outcomes. The plan will align with both programmatic and institutional priorities, focusing on integrating gender considerations into digitalization processes, fire safety regulations retrieval, and digital applications resulting from the project.

2. Programmatic Priorities

Retrieving Fire Safety Regulations:

The project involves retrieving fire safety regulations from four countries and ensuring that these regulations are integrated into BIM systems. The approach will include a gender-sensitive analysis of fire safety regulations to address any gendered vulnerabilities that may arise in fire safety situations (e.g., women, children, elderly, and people with disabilities).

Men, women and gender minorities might respond differently in emergency situations, such as fire evacuations, due to social roles, physical capabilities, or cultural norms. Elderly, children, pregnant people or people with disabilities, are underrepresented in typical building safety codes, and may have specific needs in fire evacuation strategies (e.g., with respect to reaction and decision time as well as walking speeds or more accessible exits)[4,5,6]. It's important to ensure that digitalized rules also incorporate these gendered factors and don't inadvertently leave vulnerable groups at risk during emergencies.

Building codes and standards have been historically developed based on male-dominated viewpoints and physical characteristics (e.g., average body size, strength)[7,8,9]. Even though that is beginning to change with new gender-responsive standards[10,11], it's important to assess whether older regulations are applicable or might need adjustments to ensure they are equally relevant and safe for people of all genders.

The automatically computable rules that assess compliance with fire safety codes may unintentionally overlook or prioritise certain safety issues over others based on gendered assumptions about how people use spaces. For example, codes might focus more on areas traditionally used by men (e.g., industrial areas or male-dominated workplaces), while overlooking spaces frequently used by women (e.g., nurseries or spaces catering to caregivers).

Lastly, translating regulations into computer-interpretable language requires a significant degree of interpretation, which may be subjective. To ensure that requirements are applied equitably across different user groups, it is preferable to involve a gender-balanced group of fire safety experts in the interpretation process and to raise awareness of implicit gender bias in both regulations and their interpretations.

Actions:

 - Generate awareness that regulations collected from the four countries reflect gender-sensitive data, addressing differences in evacuation needs and vulnerabilities.

 - Ensure awareness that fire safety regulations account for the specific needs of diverse groups.

- Establish gender-balanced expert panels to interpret and review chosen excerpts of fire safety regulations.

Digitalization of Fire Safety Procedures into BIM:

  The project will digitize fire safety procedures, integrating them into BIM. It is essential that the process is inclusive of gender-specific needs in fire safety design, ensuring that digital models consider the diverse requirements of all groups, including gender-specific safety features and accessibility in fire situations.

As FireBIM is experimenting with different methods of automation, including rule-based systems, natural language processing (NLP) and large language models (LLMs), proactive measures are needed to mitigate related risks. AI-driven systems have been shown to reproduce gender and racial bias due to the underrepresentation of diverse perspectives in the ICT sector[12,13]. AI systems used in regulatory automation must align with the European Commission's principles on AI governance, which emphasize transparency and accountability in algorithmic systems, promoting a human rights-based and gender-responsive approach to AI governance [14].

The project will integrate transparency and accountability mechanisms into its algorithmic processes, ensuring that rule translations and automated compliance checks are auditable and free from biased assumptions. Gender-balanced expert panels will oversee the interpretation of computable rules, verifying that regulatory requirements are applied equitably across different user groups. Furthermore, FireBIM will conduct bias audits on datasets used for NLP and rule automation, addressing potential disparities before they impact regulatory compliance assessments

Actions:

- Conduct gender assessments on the digital setups and fire safety procedures to identify and address any gaps in gender representation.

- Initiate inclusive design principles into BIM modelling, ensuring features like emergency exits, accessible routes, and signage are gender-responsive.

- Establish gender-balanced expert panels to review computable rule translations and automated interpretations of fire safety regulations.

- Conduct audits to ensure AI-driven compliance checks do not reinforce biases.

Digital Applications and Outputs:

The FireBIM project will generate several digital applications as part of its output. These tools should be designed with gender equality in mind, ensuring accessibility, usability, and inclusivity for all genders, particularly vulnerable groups. This aims at the usage of the applications but also at the functionality.

Since women and gender minorities are severely underrepresented in both the ICT and AEC industries[1,2], they will, in all likelihood, also be underrepresented amongst the corporate end-users of FireBM. Therefore, free (as in libre) access to the project's outcomes and transparent representation of the employed methods, becomes key. Restricting access to, or usage of, FireBIM to members of industries with highly uneven gender distributions, results in creating unequal access for women and gender minorities. Because of this, a focus on Free/Libre and Open Source (FLOSS) software is part of the Feminist Internet Principles, developed by the Association for Progressive Communications (APC)[15].

When designing and testing the system, it's important to ensure that the data and building case studies used for code compliance checking reflect a range of gendered experiences. For instance, scenarios involving family homes, childcare centres, or women-only spaces (such as women's shelters or maternity wards) may be underrepresented. The underlying datasets that inform building code compliance checks should ensure diverse representations of different types of buildings that are used by or designed for people of different genders.

Actions:

- Ensure that all digital applications and tools are developed with user-centred design principles, accounting for the diverse needs of different genders.

- Implement gender-disaggregated data collection for user feedback and usability testing to ensure digital applications are effective and accessible for all users.

- Provide training for project team members on incorporating gender equality principles into the development and deployment of digital applications.

- Employ Free/Libre and Open Source Software (FLOSS) principles to promote algorithmic transparency and create open-access training materials to avoid passively restricting access to women and gender minorities.

- Ensure that building case studies used in compliance checking reflect diverse gendered experiences.

3. Institutional Priorities

Gender Integration Across Project Practices:

Gender equality will be embedded into the day-to-day operations of the FireBIM project through a structured change strategy. This strategy will ensure that gender is considered at all stages of the project, from conception to execution.

Actions:

- Establish a Gender Equality Working Group (GEWG) within the project, responsible for overseeing the integration of gender considerations into all aspects of the project.

- Create a gender-sensitive project management framework, ensuring that team members are trained on gender issues and best practices.

Monitoring and Evaluation of Gender Equality Progress:

Regular monitoring and evaluation processes will track progress toward achieving gender equality within the project, assessing the impact of the change strategy and identifying areas for improvement.

Actions:

- Collect and report on gender-disaggregated data throughout the project, ensuring transparency and accountability in gender equality efforts.

4. Conclusion

The FireBIM project has a unique opportunity to address gender inequality through its focus on fire safety regulations, digitalization, and the development of digital tools. By integrating gender-sensitive strategies into all aspects of the project, we can ensure that the project not only advances fire safety and digital representations but also promotes equality and inclusivity for all individuals, regardless of gender.

Ensuring a human rights-based and gender-responsive approach to algorithmic methods and AI governance, is not just a matter of equity—it enhances the effectiveness and reliability of automated fire safety verification. By embedding intersectionality, universal design, and bias mitigation strategies, FireBIM aligns with EU priorities and contributes to a more inclusive digital transformation in fire safety automation. This Gender Action Plan will guide the FireBIM project toward achieving these objectives and ensure that gender equality is a core principle in its work.

5. References

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